Higher Education

Instructional Materials/Courses

CEOS Resources in Earth Observation

http://ceos.cnes.fr:8100/cdrom-98/astart.htm

The international Committee on Earth Observation Satellites (CEOS) has produced this resource, which contains case studies (examples of Earth observation applications to real-life problems), data and information for education and developing countries. **Recommended for: high school, undergraduate, graduate–professional.**

Chesapeake Bay from Space

http://chesapeake.towson.edu

This Web site provides a wide variety of data and tools designed to introduce decision makers to the use and interpretation of Landsat 7 imagery, primarily focusing on imagery used to measure the extent of impervious surfaces—land covers that repel water, restrict groundwater recharge, generate large volumes of storm water and degrade water quality—in the Chesapeake Bay and Maryland Coastal Bays Watersheds. It includes Landsat data and a variety of background information and tools designed for users outside the research community, including urban planning professionals, educators and the general public. **Recommended for: post secondary, state and local government officials.**

Climate Change Presentation Kit, 1999

http://www.epa.gov/enviroed/globalclimate.html

The Climate Change Presentation Kit is offered as a resource to help prepare talks for students or the general public. The toolkit allows teachers the option of picking and choosing the components that they would need to communicate climate change issues to audiences. It contains fact sheets, a PowerPoint slide presentation and interactive activities that are designed to interest audiences of all levels. Order this free CD-ROM at the Web site provided. **Recommended for: elementary–college educators, informal educators.**

Earth System Science Online Courses for K–12 Teachers

http://www.cet.edu/essea

K–12 Earth system science (ESS) online graduate courses have been developed within the Center for Educational Technology (CET) at Wheeling Jesuit University for NASA's Earth Science Enterprise. The Earth system science courses use an innovative instructional design model, are delivered over the Internet and feature student-centered, knowledge-building virtual communities. To view the courses, go to the Web site provided and click on the link for "ESSEA Courses." To find a college or university offering the courses, click on the link for "Course Offerings." **Recommended for: K–12 teacher education.**

Geomorphology from Space, 1986

http://daac.gsfc.nasa.gov/DAAC_DOCS/geomorphology/GEO_HOME_PAGE.html
http://core.nasa.gov/core.nsf/item/400.0-87

Available on CD and the Web, *Geomorphology from Space* was designed for studying landforms and landscapes. It contains a gallery of 237 color and black and white plates of space imagery, primarily of the Earth, each treating a geographic region where a particular landform theme is exemplified. Each image is paired with a detailed scientific description of the features in the image; some images are accompanied by line drawings, locator maps, geologic maps and on-the-ground photographs of the landform. Available on CD-ROM from NASA CORE at the Web site provided. **Recommended for: high school–adult.**

Studying Earth's Environment from Space

http://www.ccpo.odu.edu/SEES/index.html

This material consists of four modules designed to increase the use of satellite data in science classrooms: *Stratospheric Ozone, Global Land Vegetation, Oceanography* and *Polar Sea Ice Processes.* Lecture materials are provided, including full-color, printable graphics that are linked to guided-inquiry computer exercises. The software package used for the computer exercises is SEE Image, which is a modified version of NIH-Image. The software runs on Macintosh computers, as well as PCs that are equipped with a Macintosh emulator.
Recommended for: high school–undergraduate.

World Watcher: Global Warming Project

http://www.worldwatcher.northwestern.edu/curriculumMS.htm

Global warming and its potential impact provide the context for this unit, in which students learn about the scientific

factors contributing to the debate. Students act as advisors to the heads of state of several nations, and explore the issues as they respond to the various questions and concerns of these leaders. Activities include a combination of physical labs and investigations using World Watcher software, a geographic data visualization tool. Developed by Northwestern University. **Recommended for: middle school+.**

Resources

BOOKS

Earth from Above: Using Color-Coded Satellite Images to Examine the Global Environment, 1997

http://www.uscibooks.com

Written by NASA Goddard Space Flight Center scientist Claire Parkinson, *Earth from Above* provides an easy introduction to understanding and interpreting satellite images. Beginning with two short chapters on visible satellite images and radiation, the book then covers six key Earth-atmosphere variables on topics including the Antarctic ozone hole, El Niño, deforestation, the missing carbon dilemma, and the effects of sea ice, snow cover and volcanoes on atmospheric temperatures. A final chapter broadens the discussion to consider satellite Earth observations in general. Each section concludes with a list of questions; answers are provided at the back of the book. Available for purchase from University Science Books at the Web site provided.
Recommended for: post secondary.

Ecosystem Change and Public Health: A Global Perspective

http://www.press.jbu.edu/books/title_pages/1495.html

This textbook was published by Johns Hopkins University Press to: 1) raise awareness of changes in human health related to global ecosystem change; and 2) expand the scope of the traditional curriculum in environmental health to include the interactions of major environmental forces and public health on a global scale. The book covers such topics as global climate change, stratospheric ozone depletion, water resources management and ecology and infectious disease. Case studies of cholera, malaria, the effects of water resources and global climate change and air pollution illustrate the analysis and methodology. The book also includes a resource center describing places to start searches on the Web, guidelines for finding and evaluating information, suggested study projects and strategies for encouraging communication among course participants.
Recommended for: undergraduate.

EOS Science Plan, 1999

http://eospso.gsfc.nasa.gov/science_plan/index.php

The purpose of this plan is to state the concerns and problems facing Earth science today, and to indicate contributions that will be made toward providing solutions to those problems, primarily through the use of satellite-based observations that will be obtained with NASA EOS satellites and instruments. Seven topical chapters discuss the nature of the science being reviewed: radiation, clouds, water vapor, precipitation and atmospheric circulation; ocean circulation, productivity and exchange with the atmosphere; greenhouse gases and atmospheric chemistry; land ecosystems and hydrology; cryospheric systems; ozone and stratospheric chemistry; and volcanoes and climate effects of aerosols.
Recommended for: post secondary.

Atlas of the Ocean: The Deep Frontier, 2001

http://shop.nationalgeographic.com

Featuring more than 150 photographs, maps and NASA satellite images, this atlas charts and celebrates every aspect of the ocean world, from tiny plankton to massive storm systems that rage across thousands of miles. Experts have contributed essays and sidebars on subjects as diverse as deep-sea archeology, plate tectonics, coral reefs, mapping techniques and El Niño. Readers also go behind the scenes to observe modern science at work, as researchers pursue promising leads in dozens of different but intertwined fields. Order online at the Web site provided—or from National Geographic Society, 1145 17th Street NW, Washington, DC 20036-4688.
Recommended for: formal and informal education audiences, grade 8–adult.

BROCHURES

Aqua Brochure

http://eospso.gsfc.nasa.gov/ftp_docs/Aqua_brochure.pdf

"Aqua," Latin for "water," is a NASA satellite mission named for the large amount of information that it is collecting about the Earth's water cycle, including evaporation from the oceans, water vapor in the atmosphere, clouds, precipitation, soil moisture, sea ice, land ice and snow cover on the land and ice. Additional variables also being measured by Aqua include radiative energy fluxes,

aerosols, land vegetation cover, phytoplankton and dissolved organic matter in the oceans and air, land and water temperatures. This brochure provides a comprehensive overview of the Aqua spacecraft, instruments, science and data products. **Recommended for: post secondary and as a resource for informal educators.**

CERES—Clouds and the Earth's Radiant Energy System Brochure

http://eospso.gsfc.nasa.gov/eos_homepage/brochures/CERES.php

This brochure gives a brief description of the science research that is being done with data from the CERES instrument flying onboard NASA's Terra satellite. It also contains information about some of the data products and technical specifications. **Recommended for: undergraduate, graduate and professional.**

GRACE Brochure

http://eospso.gsfc.nasa.gov/ftp_docs/GRACE.pdf

Gravity controls everything from the motion of the ocean tides to the expansion of the entire universe. To learn more about the mysteries of gravity, twin NASA satellites named GRACE, short for the Gravity Recovery and Climate Experiment, are making detailed measurements of Earth's gravity field. This experiment could lead to discoveries about gravity and Earth's natural systems, which could have substantial benefits for society and the world's population. **Recommended for: post secondary and resource for informal educators.**

ICESat: Ice, Cloud, and land Elevation Satellite

http://icesat.gsfc.nasa.gov/ICESat_Brochure.pdf

The mission brochure for NASA's ICESat, which was launched January 12, 2003. ICESat is the benchmark Earth Observing System mission for measuring ice sheet mass balance, cloud and aerosol heights, as well as land topography and vegetation characteristics. **Recommended for: college/university instructors and students; informal educators.**

Measurements of Pollution in the Troposphere (MOPITT) Brochure

http://eospso.gsfc.nasa.gov/ftp_docs/MOPITT broch.pdf

This brochure gives a brief description of the science research that is being done with data from the MOPPITT instrument flying onboard NASA's Terra satellite. It also identifies some of the data products, as well as gives some technical specifications. **Recommended for: undergraduate, graduate–professionals.**

MODIS Brochure

http://eospso.gsfc.nasa.gov/ftp_docs/MODIS.pdf

The first NASA Earth Observing System (EOS) satellite, called Terra, was launched on December 18, 1999, carrying five remote sensors. The most comprehensive EOS sensor is MODIS, the Moderate Resolution Imaging Spectroradiometer. MODIS offers a unique combination of features: it detects a wide spectral range of electromagnetic energy; it takes measurements at three spatial resolutions (levels of detail); it takes measurements all day, every day; and it has a wide field of view. This continual, comprehensive coverage allows MODIS to complete an electromagnetic picture of the globe every two days. **Recommended for: post secondary and resource for informal educators.**

EARTH SCIENCE DATA & IMAGERY

See also the section that follows—Web Sites—for a list of individual Earth science missions.

Earth Observatory

http://earthobservatory.nasa.gov

NASA's Earth Observatory is an interactive Web-based magazine where the science-attentive public can obtain new satellite imagery and scientific information about our home planet. Visit the Earth Observatory to read feature articles on wide-ranging Earth system science topics, download datasets and images for analysis, read breaking news, learn about current and planned Earth missions, search an online library for reference materials, track natural hazards around the world in near-real time, and access interactive experiments and classroom activities. **Recommended for: general public, media, informal educators and middle school–post secondary instruction.**

EOSDIS Resources

The following resources from the EOSDIS (Earth Observing System Data and Information System) are recommended for advanced undergraduate and graduate education:

- EOSDIS Data Sampler #1: Western U.S. Wildfires 2000, Version 2
  http://ivanova.gsfc.nasa.gov/outreach/EOSDIS_CD_01_v2/start.htm
- EOSDIS Data Sampler #2: Mount Oyama Volcanic Eruptions 2000, Version 1
  http://ivanova.gsfc.nasa.gov/outreach/EOSDIS_CD-02/start.htm
- EOSDIS Posters: Geologists' Tools in Space; Mount Oyama Erupts!; Ocean and Land...Struggling for

Mastery; The Great Barrier Reef; Spin Cycle; Hurricane Energetics; Wildfire!; and August 2000 Terra Views Idaho-Montana Fires
http://ivanova.gsfc.nasa.gov/outreach/posters.html

- Living with Volcanoes Folder
http://ivanova.gsfc.nasa.gov/outreach/folders.html

Gateway to Astronaut Photography of Earth
http://eol.jsc.nasa.gov

This Web site hosts the best and most complete online collection of astronaut photographs of the Earth, including over 480,000 photos from Space Shuttle and the International Space Station. Users can search the database of photos by geographic coordinates or region, mission, features, cloud cover and many other options. The site also features an image of the week, as well as special collections of images, including: Cities, Earth Landscape, Earth-Human Interaction, Distinctive Features, Hurricanes and Weather, Earth's Water Habitat and Geographical Regions.

NASA Distributed Active Archive Centers (DAACs)
http://nasadaacs.eos.nasa.gov

The NASA DAACs are the data management and user services branches of NASA's Earth Observing System Data and Information System (EOSDIS). The DAACs process, archive, document and distribute data from NASA's past and current Earth science research satellites and field measurement programs. They were established in the early 1990s, and each DAAC serves a specific science discipline. The DAAC Alliance publishes annual feature articles *(http://nasadaacs.eos.nasa.gov/year-books/index.html)* on how these data sets are being used for wide-ranging science research and applications purposes. **Recommended for: high school educators, undergraduate, graduate–professional.**

Landsat-7 Datasets: LAN Files for Use with MultiSpec
http://landsat.gsfc.nasa.gov/education/l7downloads/index.html

This site provides a number of Landsat 7 scene subsets as LAN files that are intended for use with Purdue University's MultiSpec software. Users also have the option of downloading the Landsat images as TIFF files in four different band combinations. Links are included to download MultiSpec, a MultiSpec tutorial, and an introduction to remote-sensing PowerPoint presentation with detailed notes. **Recommended for: middle school–undergraduate.**

United States of America Digital Landsat Mosaics: a 4-CD set of Landsat satellite imagery of the fifty states
http://catalog.core.nasa.gov/core.nsf/item/400.1-52

Using the US Digital Landsat Mosaics, we can increase our understanding of Earth system science and the effects humans have on the global environment. The mosaics were developed primarily from data collected by the Landsat 4 and Landsat 5 satellites as they orbited the Earth ten or more years ago. This historical imagery is a valuable record of the conditions on Earth around 1990. The CD was developed by NASA Stennis Space Center and the US Geological Survey. It also includes a basic Landsat tutorial. **Recommended for: high school–adult.**

Visible Earth
http://visibleearth.nasa.gov

This companion site to the NASA *Earth Observatory (http://earthobservatory.nasa.gov)* is a comprehensive image gallery for access to NASA Earth science images, animations and data visualizations. Most resources are available digitally at multiple resolutions, with captions and metadata. **Recommended for: media and general public.**

WEB SITES

Destination Earth
http://www.earth.nasa.gov

Destination Earth is the official Web site for ESE. It includes current ESE news and events, sections on education for teachers and students and information on current research opportunities. Many links to other information resources are also included.

Earth Science Picture of the Day (EPOD)
http://epod.usra.edu

The EPOD Web site is a collaboration between NASA's Goddard Space Flight Center and the Universities Space Research Association. A new photograph or image highlighting an interesting or unusual aspect of the Earth's system appears every day. Each picture is accompanied by a detailed description and related links. Search the archive by keyword or browse by field or topic. **Recommended for: middle school+, informal education.**

Earth Observatory
http://earthobservatory.nasa.gov

NASA's *Earth Observatory* is an interactive Web-based magazine where the science-attentive public can obtain new satellite imagery and scientific information about

our home planet. Visit the *Earth Observatory* to read feature articles on wide-ranging Earth system science topics, download datasets and images for analysis, read breaking news, learn about current and planned Earth missions, search an online library for reference materials, track natural hazards around the world in near-real time, and access interactive experiments and classroom activities. **Recommended for: general public, media, informal educators, and middle school–post secondary instruction.**

EOS Project Science Office

http://eospso.gsfc.nasa.gov

The Earth Observing System (EOS) is the centerpiece of NASA's ESE. It is composed of a series of satellites, a science component and a data system supporting a coordinated series of satellites for long-term global observations of the land surface, biosphere, solid Earth, atmosphere and oceans. The EOS Project Science Office is committed to bringing program information and resources to program scientists and the general public alike. Visit the project's Web site to find resources for educators, including educational links and publications from the EOS program. **Recommended for: elementary–secondary educators, undergraduate–graduate.**

NASA Earth Science Missions—Education and Public Outreach

Many of NASA's Earth science missions have an education and/or public outreach component. These efforts include a wide variety of activities and resources for educators, students and the public, including teacher workshops, public programs and events and curriculum and classroom materials. Visit the Web sites listed with each mission for specific information on a mission's programs and resources, including access to satellite imagery and other data. Missions are listed by year of launch or scheduled launch.

TOPEX/Poseidon

http://sealevel.jpl.nasa.gov/education/education.html

Jointly sponsored by NASA and CNES, the French space agency, the TOPEX/Poseidon satellite uses radar altimeters to continuously survey ocean surface height. The Jason-1 satellite joined TOPEX/Poseidon in orbit in 2001 to collect similar data.

Scientists are using TOPEX/Poseidon and Jason-1 data to learn more about global ocean circulation patterns, including phenomena such as El Niño/La Niña. Oceans are a key mechanism in transporting heat from the Sun around the globe. Researchers are working to improve understanding of the role oceans play in controlling seasonal variations and longer-term climate changes. Ocean altimetry data are also used for operational purposes, including ship routing, fisheries management, hurricane forecasting and support of underwater activities like cable laying. **CONTACT**: Annie Richardson or Mona Jasnow, Jet Propulsion Laboratory, **Email:** topex@jpl.nasa.gov. (Launched: 1992)

SeaWiFS

http://seawifs.gsfc.nasa.gov/SEAWIFS/TEACHERS

The Sea-viewing Wide Field-of-view Sensor (SeaWiFS) is providing quantitative data on global ocean bio-optical properties. Subtle changes in ocean color signify various types and quantities of marine phytoplankton (microscopic marine plants), the knowledge of which has both scientific and practical applications. SeaWiFS has helped us to not only monitor the short-term spatial and temporal variability in the ocean's biology, but also to have the first well-calibrated, long-term data set that allows us to quantify the ocean's biological response to global change. (Launched: 1997)

Tropical Rainfall Measuring Mission (TRMM)

http://trmm.gsfc.nasa.gov
http://strategies.org/TRMM.html

TRMM is a joint mission between NASA and the National Space Development Agency of Japan (NASDA). It is designed to monitor and study tropical rainfall and the associated release of energy that helps to power the global atmospheric circulations shaping both weather and climate around the world. **CONTACT:** Jeffrey Halverson, TRMM Education and Outreach Scientist, Code 912, NASA Goddard Space Flight Center, Greenbelt, MD 20771, **Phone:** 301-614-6333, **Email:** halverson@agnes.gsfc.nasa.gov. (1997 launch)

ACRIMSAT

http://acrim.jpl.nasa.gov/education/eduindex.html

Using the Active Cavity Radiometer Irradiance Monitor (ACRIM) III instrument, the ACRIMSAT spacecraft provides long-term, precise measurements of the total amount of the Sun's energy that falls on our planet's surface, oceans and atmosphere. ACRIM I was the first instrument to clearly show that the energy from the Sun is not a constant value but instead varies over time. These energy changes are small but significant, and they cycle approximately every 11 years. ACRIMSAT data is vital to helping scientists build more accurate climate models. (Launched: 1999)

Landsat 7

http://landsat.gsfc.nasa.gov/main/education.html

The Landsat 7 satellite is acquiring remotely-sensed images of land surface and coastal regions for global change research, regional environmental change stud-

ies, national security uses and other civil and commercial purposes. The Landsat 7 data set will provide the first high-resolution view of both seasonal and interannual changes in the terrestrial environment. **CONTACT:** Stephanie Stockman, Code 921, NASA Goddard Space Flight Center, **Phone:** 301-614-6457, **Email:** stockman@core2.gsfc.nasa.gov. (Launched: 1999)

SeaWinds on QuikSCAT
http://winds.jpl.nasa.gov/education

The SeaWinds instrument on the QuikSCAT satellite is a "quick recovery" effort to fill the gap created by the loss of data from the NASA Scatterometer (NSCAT) when the satellite lost power in June of 1997. SeaWinds is a specialized microwave radar that measures near-surface wind speed and direction over the Earth's oceans under all weather and cloud conditions. **CONTACT:** Peter Falcon, Scatterometer Projects Outreach Coordinator, Jet Propulsion Laboratory, 4800 Oak Grove Dr., MS TR 1722-114, Pasadena, CA 91109-8099, **Phone:** 818-393-0729, **Fax:** 818-354-8813, **Email:** pcfalcon@pop.jpl.nasa.gov. (Launched: 1999)

Terra
http://terra.nasa.gov

Terra, the flagship satellite of NASA's Earth Observing System, is collecting what will ultimately become a new, 15-year global data set on the state of the land, oceans and atmosphere. Data from this mission are used in many research and commercial applications. **CONTACT:** David Herring, Code 913, NASA Goddard Space Flight Center, Greenbelt, MD 20771, **Phone:** 301-614-6219, **Email:** dherring@climate.gsfc.nasa.gov. (Launched: 1999)

EO-1
http://eo1.gsfc.nasa.gov/Education/eo1Education.html

Earth Observing-1 (EO-1) is the first flight of NASA's New Millennium Program (NMP). Its mission is to validate technologies that will reduce the cost and increased capabilities of upcoming land-imaging missions. As a result of EO-1, future spacecraft will be an order of magnitude smaller and lighter than current versions. **CONTACT:** Joseph Young, EO-1 Mission Technology Transfer Manager, NASA Goddard Space Flight Center, **Phone:** 301-286-8146, **Email:** joseph.p.young.1@gsfc.nasa.gov. (Launched: 2000)

Jason-1
http://sealevel.jpl.nasa.gov/education/education.html

Jointly sponsored by NASA and CNES, the French space agency, Jason-1 is a follow-on mission to TOPEX/Poseidon. See TOPEX/Poseidon (1992 launch) listing on p. 25 for additional details. (Launched: 2001)

SAGE III/METEOR-3M
http://www-sage3.larc.nasa.gov

The Stratospheric Aerosol and Gas Experiment (SAGE) III mission on the Russian Meteor-3M spacecraft seeks to enhance our understanding of natural and human-derived atmospheric processes by providing high-latitude, long-term measurements of the vertical structure of aerosols, ozone, water vapor and other important trace gases in the upper troposphere and stratosphere. **CONTACT:** David Woods, NASA Langley Research Center, Hampton, VA 23681, **Email:** d.c.woods@larc.nasa.gov. (Launched: 2001)

Aqua
http://aqua.nasa.gov

Latin for "water," Aqua is named for the large amount of information the mission is collecting about the Earth's water cycle, including evaporation from the oceans, water vapor in the atmosphere, clouds, precipitation, soil moisture, sea ice, land ice and snow cover on land and ice. Additional variables also being measured by Aqua include radiative energy fluxes, aerosols, vegetation cover on land, phytoplankton and dissolved organic matter in the oceans and air, land and water temperatures. **CONTACTS:** Claire Parkinson, Code 971, NASA Goddard Space Flight Center, Greenbelt, MD 20771, **Phone:** 301-614-5715, **Email:** claire.l.parkinson@nasa.gov; Steve Graham, Code 900, NASA Goddard Space Flight Center, **Phone:** 301-614-5561, **Email:** steven.m.graham.2@gsfc.nasa.gov. (Launched: 2002)

GRACE
http://www.csr.utexas.edu/grace/education

The second of the Pathfinder missions, the Gravity Recovery and Climate Experiment (GRACE) employs a satellite-to-satellite microwave tracking system to measure the Earth's gravity field and its variability over time. Such measurements are directly coupled to long-wavelength ocean circulation processes and to the transport of ocean heat to the Earth's poles. **CONTACT: Email:** grace_edu@tsgc.utexas.edu. (Launched: 2002)

SeaWinds on ADEOS II
http://winds.jpl.nasa.gov/education

The Advanced Earth Observing Satellite (ADEOS) II is a joint mission with the National Space Development Agency of Japan (NASDA). The SeaWinds scatterometer is a specialized microwave radar that measures near-surface wind velocity (both speed and direction) over the Earth's oceans under all weather and cloud conditions. **CONTACT:** Peter Falcon, Scatterometer Projects Outreach Coordinator, Jet

Propulsion Laboratory, 4800 Oak Grove Dr., MS TR 1722-114, Pasadena, CA 91109-8099, **Phone:** 818-393-0729, **Fax:** 818-354-8813, **Email:** pcfalcon@pop.jpl.nasa.gov. (Launched: 2002)

ICESat

http://icesat.gsfc.nasa.gov/publicoutreach.html

The Ice, Cloud and Land Elevation Satellite (ICESat) operates the Geoscience Laser Altimeter System (GLAS). GLAS is accurately measuring the elevation of the Earth's ice sheets, clouds and land. Data is available from the National Snow and Ice Data Center *(http://nsidc.org/daac/icesat)*. **CONTACT: Email:** webmaster@icesat.gsfc.nasa.gov. (Launched: 2003)

SORCE

http://lasp.colorado.edu/sorce/edu_outreach.html

The Solar Radiation and Climate Experiment (SORCE) mission is providing state-of-the-art measurements of incoming x-ray, ultraviolet, visible, near-infrared and total solar radiation. The measurements provided by SORCE specifically address long-term climate change, natural variability and enhanced climate prediction, as well as atmospheric ozone and UV-B radiation. These measurements are critical to studies of the Sun and its effect on the Earth system. **CONTACT:** Gary Rottman, Laboratory for Atmospheric and Space Physics, Campus Box 590, University of Colorado, Boulder, CO 80309-0590, **Phone:** 303-492-8324, **Email:** gary.rottman@lasp.colorado.edu. (Launched: 2003)

Aura

http://aura.gsfc.nasa.gov/outreach

Aura will study the Earth's ozone, air quality and climate. The mission is designed exclusively to conduct research on the composition, chemistry and dynamics of the Earth's upper and lower atmosphere. **CONTACT:** Stephanie Stockman, Code 921, NASA Goddard Space Flight Center, **Email:** stockman@core2.gsfc.nasa.gov. (Scheduled launch: 2004)

GIFTS

http://tellus.ssec.wisc.edu/outreach/gifts/gifts.htm

The Geosynchronous Imaging Fourier Transform Spectrometer (GIFTS) will make revolutionary advances in weather observations and potentially improve weather forecasts by making vertical and horizontal measurements of winds, water vapor and temperature in the Earth's atmosphere from a geosynchronous orbit. **CONTACT:** Arlene Levine, NASA Langley Research Center, Hampton, VA 23681-0001, **Phone:** 757-864-3318, **Email:** a.s.levine@larc.nasa.gov. (Scheduled launch: 2005)

CALIPSO

http://www-calipso.larc.nasa.gov/outreach

The Cloud-Aerosol Lidar and Infrared Pathfinder Satellite Observations (CALIPSO) satellite will produce the first global three-dimensional view of aerosols and clouds. It will improve our understanding of the role aerosols and clouds play in the processes that govern climate responses and feedbacks, and improve the representation of aerosols and clouds in models, leading to more accurate predictions of climate change. Accurate climate model predictions will provide international and national leaders with reliable information to make more informed policy decisions about global climate change. CALIPSO will fly in formation with Cloudsat (see next listing) and other satellites. **CONTACTS:** Dianne Robinson, Outreach Director for CALIPSO, Interdisciplinary Science Center (ISC), Hampton University, **Email:** dianne.robinson@hamptonu.edu; Barbara Maggi, Assistant Outreach Director for CALIPSO, Center for Atmospheric Sciences (CAS), Hampton University, **Email:** barbara.maggi@hamptonu.edu. (Scheduled launch: 2005)

CloudSat

http://cloudsat.atmos.colostate.edu/outreach

CloudSat will provide vertical profiling from space of the full range of clouds, from thin cirrus to thick, precipitating convective clouds. It will also provide the first quantitative estimates of ice in clouds. The mission will fill a critical gap in the investigation of feedback mechanisms linking clouds to climate. CloudSat will orbit in formation as part of a constellation of satellites including Aqua, Aura and CALIPSO. One of the unique features that CloudSat brings to this constellation is the ability to fly a precise orbit, enabling the footprint of the CloudSat radar to be overlapped with that of the CALIPSO lidar, as well as with other instruments in the constellation. The precision of this overlap creates a unique multi-satellite observing system for studying atmospheric processes essential to the hydrological cycle. **CONTACT:** Debra Krumm, Outreach Coordinator, Department of Atmospheric Science, Colorado State University, Fort Collins, CO 80523-1371, **Phone:** 970-491-8790, **Email:** dkrumm@atmos.colostate.edu. (Scheduled launch: 2005.)